

Fig. 3.

1886
(Cont'd)

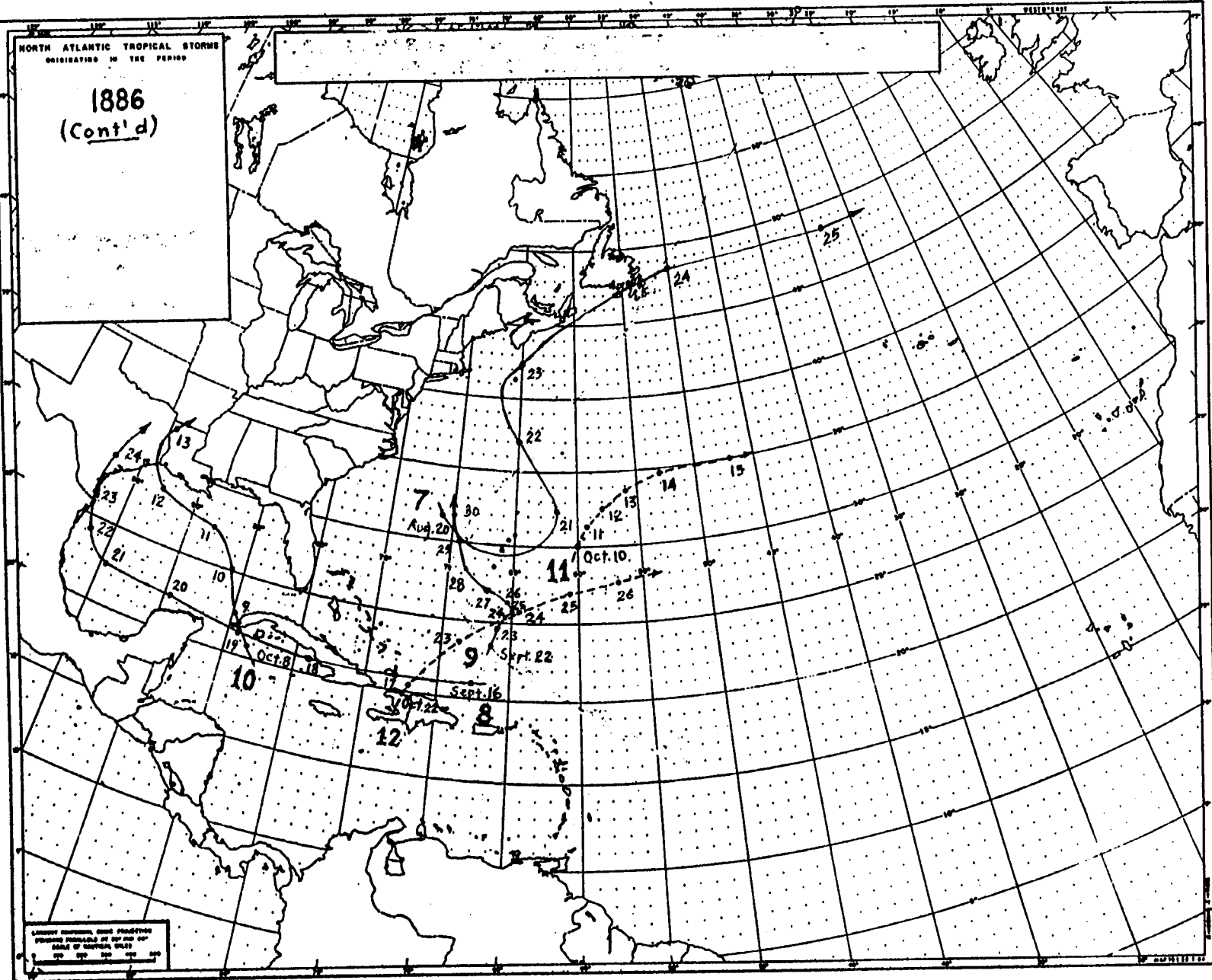


Fig. 3 (Cont'd).

Weather Review, Aug. 1886). 19) The hurricane recurved over Ensenada de Jucaro on Aug. 21 (Vines, 1895). Author's note: Ensenada de Jucaro is located on the southern coast of Cuba near the 79 degrees W. meridian. Father Vines attributed the recurvature at such an unusually low latitude for August to an interaction between this hurricane and the one which was on the Texas coast on Aug. 20 (Storm 5, 1886). 20) Aug. 21-22. Intense hurricane moved across Cuba in the vicinity of La Trocha. It devastated the municipalities of Santa Clara, Jucaro, Ciego de Avila and Moron. The cyclone came from St. Vincent, passed over Jamaica and recurved S. of Ensenada de Jucaro (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). La Trocha is a name used to designate the relative narrow portion of Cuba near long. 79 W., between the towns of Jucaro on the southern coast and Moron on the northern coast. 21) The storm passed N. over Cuba in about 81 degrees W. during Aug. 22 (Monthly Weather Review, Aug. 1886). Author's note: Long. 81 W. is definitively too far W. According to items 19) and 20), the storm crossed Cuba near long. 79 W. 22) Havana, Sept. 10. Further particulars of the damage done by the cyclone of Aug. 20-23 have been received. In Manzanillo, Jucaro, Ciego de Avila, Moron and other districts hundreds of houses were overturned and a large number of cattle were drowned. The number of trees blown down was great (The Times, London, Sept. 11, 1886, p.1, col.2). 23) A hurricane swept over the island of New Providence (Nassau) on the night of Aug. 22. The gale was from the S.E. and blew with great violence for several hours. Sailing vessels dragged their anchors and went ashore or were driven over the bar and out to sea. Reports from the Berry Islands and Andros state that the storm there was very heavy and that many sponging and fishing vessels were wrecked. Some loss of life is also reported (Monthly Weather Review, Aug. 1886). Author's note: The New York Times, Aug. 31, 1886, p.1, col.4, also published a similar narrative about the storm in the Bahamas. 24) Bark "Flash Light". Aug. 24, lat. 34 N., long. 74 W., had a hurricane from S.E. veering to W., blowing with terrific fury; considerable damage caused to the vessel (Monthly Weather Review, Aug. 1886). 25) Schr. "Gertie M. Rickerson". Aug. 24, lat. 34 N., long. 73 W., took a hurricane from S.S.E. to W., lasting 8 hours (Monthly Weather Review, Aug. 1886). 26) Bark "Newcombe". Aug. 24 and 25; lat. 36 N., long. 72 W. (at 3:30 A.M. Aug. 25), had a hurricane from S.S.E. to W., lasting 24 hours (Monthly Weather Review, Aug. 1886). 27) Bark "Mohican", in lat. 37 10 N., long. 71 24 W. (at 6 A.M. Aug. 25), had a whole gale from S.S.E. to W.S.W. (Monthly Weather Review, Aug. 1886). 28) Steamship "Canada", in lat. 40 28 N., long. 67 12 W. (at midnight Aug. 25-26), had a gale from E., backing to N., with heavy rain; lowest barometer 29.44 inches (Monthly Weather Review, Aug. 1886). 29) Schr. "L.A. Plummer". Aug. 25, lat. 40 50 N., long. 69 10 W. (at 8 P.M.), had a hurricane from E.N.E. backing to N.W. (Monthly Weather Review, Aug. 1886). 30) Ship "Emily F. Whitney". Aug. 25, lat. 39 48 N., long. 69 15 W. (at noon), had a hurricane from S.E. commencing at 10 P.M. with heavy seas; hurricane continued on Aug. 26, lat. 39 29 N., long. 69 51 W. at noon, backing to E., N.E. and N.W. and moderating at 6 P.M.; barometer at noon Aug. 26: 29.85

inches (Monthly Weather Review, Aug. 1886). Author's note: The barometer reading appears to be too high. In addition, ship's positions are highly suspected because they are only about 30 miles apart, implying that the ship sailed at only 2-3 knots. 31) Bark "Benj. F. Hunt, Jr." Aug. 25, lat. 34 22 N., long. 69 48 W. (at noon), had a terrific gale from S. commencing at 10 P.M. and continuing on Aug. 26, the wind shifting to W. and N.W. and moderating after 4 P.M. (Monthly Weather Review, Aug. 1886). Author's note: At least the latitude given by this vessel seems to be in error. 32) Bark "John H. Pearson" had a heavy gale from E., backing to N. on Aug. 25 in lat. 40 40 N., long. 68 20 W. (Monthly Weather Review, Aug. 1886). 33) Bark "Harvester". Aug. 25, lat. 40 33 N., long. 66 08 W. (at noon). At 7 P.M., strong S.E. breeze with very heavy thunder and lightning and rain. Aug. 26, 9 A.M., gale increased; wind S.E. with a very heavy sea and also a heavy sea coming up from W.S.W.; at 1 P.M. the gale increased to hurricane force with very heavy sea, W.S.W., breaking. The hurricane lasted about 8 hours, gradually drawing to the W. and from there to the N.W., in a strong gale, decreasing in violence; lowest barometer 29.20 inches (Monthly Weather Review, Aug. 1886). Author's note. The meaning of a few of the statements above is not clear. 34) Steamship "Camellia". Aug. 25, in lat. 39 20 N., long. 69 42 W., had a very strong E.N.E. gale, shifting to N. and lasting from noon until 8 P.M.; barometer 29.48 inches; heavy squalls of wind and rain and heavy seas (Monthly Weather Review, Aug. 1886).

On the basis of a large number of the items above, some modifications along the track for Storm 6, 1886 in Neumann et al. (1993) were introduced for the period Aug. 15-22. However, positions for the period Aug. 23-27 were found to be either in agreement with the marine information available for Aug. 24 and 25 or impossible to be verified because of insufficient or non-existing information; in both cases the positions in Neumann et al. (1993) were kept unchanged. Consequently, the author of this study estimated new 7 A.M. positions for the days as follows: Aug. 15, near 14.3 degrees N., 56.5 degrees W., on the basis of information in items 1) and 2); Aug. 16, near 13.0 degrees N., 61.3 degrees W., primarily based on information in item 3); Aug. 17, 12.5 degrees N., 66.5 degrees W., based on space-time continuity and information in items 8) and 9), this position is slightly to the W. of the one in Neumann et al. (1993); Aug. 18, near 13.0 degrees N., 71.7 degrees W., primarily based on space-time continuity using information in items 9) and 10); Aug. 19, near 14.7 degrees N., 74.5 degrees W., on the basis of item 10) and space-time continuity; Aug. 20, near 18.5 degrees N., 77.3 degrees W., based on information in items 13) through 15); Aug. 21, near 21.0 degrees N., 79.0 degrees W., based on information in item 20); Aug. 22, near 22.0 degrees N., long. 79.0 degrees W., chiefly based on item 20). The above mentioned positions for Aug. 15-22, as well as the positions for Aug. 23-27 in Neumann et al. (1993) which were kept unchanged, were used to prepare the storm track which is displayed in Fig. 3.

The hurricane status given to Storm 6, 1886 in Neumann et al. (1993) was found to be fully supported by the content of a number of the above items, including the barometer readings of 28.90

inches reported by the "Kestrel" (item 9) and 28.86 inches reported by the "Claribel" (item 13). It is even possible that the storm might have been a major hurricane as suggested by the nomenclature used in item 20).

Storm 7, 1886 (Aug. 20-25), H.

This storm represents a new case in the sense that it is not included in Neumann et al. (1993). However, the Monthly Weather Review, Aug. 1886, has referred to this storm before, and even indicated a probable tropical origin and offered a track for it.

Documentation of this storm case was based on the following information: 1) Bark "Argyll". Aug. 20, lat. 32 10 N., long. 71 50 W., had a gale from S., hauling around by E. to N.W. and going around the compass 3 times in two and a half hours, blowing with terrific force, accompanied by vivid lightning, terrific thunder and torrents of rain, the sea being one mass of foam, breaking in all directions; the storm passed S.E., leaving the ship with a hard gale from the N.E. (Monthly Weather Review, Aug. 1886). 2) Bark "Edwin Reed". Aug. 21, lat. 33 N., long. 62 25 W., encountered a hurricane from E. veering to N. to S.S.E., which blew with special fury for 4 hours, injuring two of the crew and causing considerable damage to the vessel; lowest barometer 28.40 inches at 11 A.M. (Monthly Weather Review, Aug. 1886). 3) Bark "Theresina". Aug. 21, lat. 33 50 N., long. 63 W., had a hurricane from E.S.E. veering to N. (Monthly Weather Review, Aug. 1886). 4) Steamship "Victoria". Aug. 21, lat. 34 47 N., long. 62 29 W., encountered a hurricane; wind set in from E., changed to N. during and to S.S.W. following the passage of the disturbance; lowest barometer 28.45 inches at midnight Aug. 21 (Monthly Weather Review, Aug. 1886). 5) Ship "Coringa". Aug. 22, lat. 40 30 N., long. 67 W., experienced a hurricane, wind S.S.W. changing to E. and N.W.; lowest barometer at 4 P.M. (Monthly Weather Review, Aug. 1886). 6) Bark "Toivo". Aug. 22, lat. 41 01 N., long. 66 21 W. (at 3 P.M), had a hurricane, wind set in from E. and backed to N.W.; the hurricane was preceded by very heavy sea from S.W., accompanied by very heavy chopped sea and torrents of rain; lowest barometer 29.25 inches at 3 P.M. (Monthly Weather Review, Aug. 1886). 7) Steamship "The Queen". Strong gale commenced from S.E. at 10 A.M. Aug. 22 and ended at midnight the same day; wind veered to N.; lowest barometer 29.60 inches at 11 P.M. (Monthly Weather Review, Aug. 1886). Author's note: No position was given. 8) Steamship "Servia". Aug. 22, had a strong gale from N.E., veering to S.; lowest barometer 29.59 inches in lat. 40 44 N., long. 65 15 W. at 4 P.M; from 7 A.M. to 6 P.M. had constant and heavy rain with very thick weather (Monthly Weather Review, Aug. 1886). 9) Steamship "Normandie". Aug. 22, lat. 40 45 N., long. 66 20 W., had a hurricane from noon to 8 P.M.; wind set in from N.E. and hauled slowly to the S.W. passing by E., S.E. and S. with force 10 of 12 (on the Beaufort scale). The sea was monstrous and cross, coming from N.E. and S.E. at the same time. The barometer fell to 29.02 inches and rose from 8 P.M. as the wind abated. Very heavy rain fell during the hurricane (Monthly Weather Review, Aug. 1886). 10) Steamship "Rhyndland". Had a whole gale on Aug. 22 and 23, from N.E. backing to N.W.; lowest barometer 29.17

inches at midnight Aug. 23 (it should read midnight Aug. 22-23) in lat. 41 12 N., long. 67 W. (Monthly Weather Review, Aug. 1886). 11) Steamship "St. Ronans". Aug. 22 at 9 P.M. in lat. 42 N., long. 62 45 W., had a terrific gale; wind hauled to S. and S.W. at 10 P.M. (Monthly Weather Review, Aug. 1886). Author's note: Long. 62 45 W. seems to be too far east if "Aug. 22 at 9 P.M." were correct. 12) Steamship "Persian Monarch". Aug. 23, lat. 44 N., long 62 W. (at 4 P.M.), had a strong gale from S., veering to N.W.; lowest barometer 29.70 inches (Monthly Weather Review, Aug. 1886). 13) Gloucester, Ma., Aug. 26. Several vessels from the George and Grand Banks arrived here and reported a severe storm on Aug. 23 (it should read Aug. 22 and 23). Schr. "David Sherman" was struck by the cyclone Sunday morning (Aug. 22) at George Bank. The "Joseph Garland" was thrown on her beam ends. The "Gatherer" took the gale off Cape Sable and the "A.T. Gifford" had sails blown to pieces and her foreboom broken. The gale was reported to have been the worst over the Banks in many years (The New York Times, Aug. 27, 1886, p.5, col.3). 13) Halifax, Aug. 29. The bark "Naomi", from New York for Settin, put into this port this morning disabled. She was out in the terrific storm of Sunday last (Aug. 22) during which her deck was swept and her cabin completely destroyed (The New York Times, Aug. 30, 1886, p.1, col.4). 14) Halifax, Sept. 3. The brigantine "P.J. Palmer" (from Portland, Me. to Buenos Aires, Argentina), encountered a strong gale on Saturday (it should read Sunday) Aug. 22, which by night veered to S. and increased to a terrific hurricane, causing a tremendous sea (The New York Times, Sept. 4, 1886, p.2, col.6). 15) Halifax, Sept. 3. The schooner "Elizabeth Foster" was in a heavy gale on Sunday Aug. 22 (The New York Times, Sept. 4, 1886, p.2, col.6). 16) Steamship "Anchoria". Aug. 24, lat. 42 N., long. 63 W. (at 2 P.M.), had a fresh gale from S.W. to N.W.; lowest barometer 29.79 inches at 2 P.M. (Monthly Weather Review, Aug. 1886). Author's note: This information might not be related with this particular storm. 17) Steamship "Canada". Aug. 24, lat. 42 16 N., long. 61 30 W., had a fresh gale from S.S.W. veering to N.W.; lowest barometer 29.83 inches at 4 P.M. (Monthly Weather Review, Aug. 1886). Author's note: This information might not be related to this particular storm either. 18) Map showing a track for the storm. Daily positions were read off the map as follows: Aug. 20, 32.5 degrees N., 70.7 degrees W; Aug. 21, 33.3 degrees N., 61.7 degrees W.; Aug. 22, 40 degrees N., 65 degrees W., Aug. 23, 44 degrees N., 65 degrees W.; Aug. 24, 48.5 N., 50 degrees W.; Aug. 25, 48.3 degrees N., 33.3 degrees W. The track was ended at 50 degrees N., long. 29 degrees W. (Monthly Weather Review, Aug. 1886).

Based on information in item 1), the author of this study estimated a 7 A.M. Aug. 20 position near 31.7 degrees N, 71.0 degrees W. and then started a track oriented to the S.E., the E. and the N.E. to avoid the island of Bermuda by having the storm passed about 175 miles to the S. in compliance with the fact that, according to Tucker (1982), no gale of tropical origin affected that island in 1886. The author's position for Aug. 21 was near 32.3 degrees N., 61.7 degrees W. and was based on items 2) and 3). A careful analysis of the information contained in items 4) through 10) allowed the author to estimate a 7 A.M. Aug. 22 position near

37.0 degrees N., 65.0 degrees W. The author's estimated position for Aug. 23 was near 42.3 degrees N., 65.0 degrees W. and was primarily based on the content of items 10) and 12). Positions for 7 A.M. Aug. 24 and 7 A.M. Aug. 25 were taken from item 18). These positions were near 48.5 degrees N., 50.0 degrees W. and near 48.3 degrees N., 33.3 degrees W. for Aug. 24 and for Aug. 25, respectively. The author's track for Storm 7, 1886 is displayed in Fig. 3.

Information contained in a number of the above items clearly indicated that the storm attained hurricane intensity and the fact that barometer readings as low as 28.45 inches and 28.40 inches were reported by the "Victoria" (item 4) and the "Edwin Reed" (item 2), respectively, strongly suggested that Storm 7, 1886 was a major hurricane.

Storm 8, 1886 (Sept. 16-24), H.

This is the same storm which Neumann et al. (1993) identify as Storm 7, 1886.

The following information was found about this storm: 1) Steamship "Edith Godden". Sept. 15, from lat. 21 N., long. 74 18 W. to lat. 30 N., long. 75 30 W., had moderate and strong E. gales and high easterly sea. Noon Sept. 16, barometer 29.85 inches; at 4 and 8 P.M. and at midnight (Sept. 16-17), barometer 29.79 inches; 8 A.M. Sept. 17, barometer 29.74 inches; at noon, in lat. 23 06 N., long. 74 30 W., the barometer had risen slightly; 3:30 P.M., heavy and frequent squalls and every appearance of bad weather; 4 P.M., barometer 29.73 inches; 6 P.M., barometer 29.70 inches, moderate E. gale, high sea, heavy squalls, gale moderating during the evening, wind continued easterly; 8:30 P.M., barometer 29.73 inches, squalls getting heavier and more frequent; 11:30 P.M., barometer 29.70 inches, moderate E. gale, high sea from E. and heavy squalls (Monthly Weather Review, Sept. 1886). 2) Steamship "Ozama". Sept. 16 commenced with fresh S.S.E. wind and cloudy sky; noon, wind refreshed with high sea; 6 P.M., barometer 29.85 inches, wind increased to a storm, with tremendous sea, hove ship to, heading E., riding easy; 4 A.M. Sept. 17, lat. 23 30 N., long. 70 45 W., barometer 29.82 inches; 6 P.M., barometer rising. During the past 24 hours tremendous squalls. Noon Sept. 18, arrived at Turk's Island. The wind during the storm was S.E. to N.E. 3) A fairly well-defined depression apparently passed westward S. of Haiti and Cuba during Sept. 16-18 and entered the southern portion of the Gulf (of Mexico) on Sept. 19 (Monthly Weather Review, Sept. 1886). Author's note: A cyclone passing to the S. of Haiti seems to be too far south to have produced the gales, and specially the relatively low barometer readings, reported in items 1) and 2). 4) Storm of Sept. 15-25. Martinique, Jamaica, Brownsville. In 1886, a hurricane which had previously passed near Martinique and Jamaica crossed the coast near Brownsville (Tannehill, 1938). Author's note: It is hard to explain the weather conditions described in items 1) and 2) as resulting from a hurricane which passed as far south as Martinique and Jamaica. Only a strong hurricane of an unusually large diameter could have caused such an event and this is unlikely to have been the case. It looks more plausible to believe that the storm passed

just N. of Hispaniola and not south of that island as implied in accepting a Martinique-Jamaica track. 5) Brownsville, Tx. During the night of Sept. 21-22, E. winds prevailed, attaining at 10 P.M. a velocity of 24 mph. Fresh and high E winds prevailed during Sept. 22. At 1:30 P.M. the barometer began falling rapidly, reading 29.54 inches at 3 P.M. and 29.15 inches at 11 P.M. During the afternoon the wind increased in force, attaining at 9:30 P.M. a velocity of 68 mph from E. The gale prevailed until 12:30 A.M. (Sept. 23) when the wind lulled and the barometer began to rise. At 2 AM the wind veered to W. and began blowing hard, attaining between 3 and 9:45 A.M. (Sept. 23) the force of a gale; maximum velocity was 39 mph. During the four days that the storm prevailed (Sept. 20-23), 25.98 inches of rain fell (Monthly Weather Review, Sept. 1886). 6) Storm of Sept. 23-24. Lower Texas coast. Minimal, 25.98 inches of rain near Brownsville (Dunn and Miller, 1960). 7) Philadelphia, Sept. 29. A great storm raged over S.E. Texas during the past week. During Sept. 21-23, 26 inches of rain fell at Brownsville. The wind reached the velocity of 100 mph and more than 200 houses in Brownsville were blown down (The Times, London, Sept. 30, 1886, p.3, col.6). 8) Corpus Christi, Tx. At 3 P.M. Sept. 24 (it should read Sept. 23) the gale attained a velocity of 68 mph from N.E. and was accompanied by very heavy rain. The tide was very high, overflowing the lower part of the town and carrying away thousands of ties from the Mexican-National and the Aransas Pass railways (Monthly Weather Review, Sept. 1886) 9) Galveston, Tx. At 1:20 P.M. Sept. 22, an E. gale of 27 mph set in; heavy rain and gale continued throughout the night. Light rain fell during Sept. 23; at 11:35 P.M. a S.E. gale set in and continued until 9:40 A.M. Sept. 24; maximum velocity was 34 mph (Monthly Weather Review, Sept. 1886).

Based on information in some of the items above, the author of this study proposed a series of modifications along the track shown in Neumann et al. (1993) prior to Sept. 22 and as for Storm 7, 1886 in their publication. After a careful analysis, he decided to weight heavily the content of items 1) and 2) and to discard a trajectory Martinique-Jamaica passing to the S. of Haiti which was suggested in items 3) and 4). By so doing, the possibility of having had two different storms moving simultaneously along almost parallel tracks just a couple hundred miles apart (one to the north and the second to the south of Hispaniola) was also discarded as an event of extremely unlikely occurrence. The author then started a track passing to the N. of Haiti, crossing eastern Cuba and then continuing south of this latter island to enter the Gulf of Mexico through the Yucatan Channel. Author's estimates for 7 A.M. positions were as follows: Sept. 16, 21.0 degrees N., 67.7 degrees W., based on information in item 2) and backward extrapolation; Sept. 17, 21.0 degrees N., 73.0 degrees W., primarily based on information in item 1); Sept. 18, 21.0 degrees N., 79.0 degrees W., based on information in item 1) and on space-time continuity; Sept. 19, 21.5 degrees N., 84.3 degrees W., based on space-time continuity and on information in item 3); Sept. 20, 22.3 degrees N., 89.7 degrees W., essentially based on space-time continuity; Sept. 21, 22.5 degrees N., 94.7 degrees W., essentially based on space-time continuity along a smooth track after allowing for a

slight deceleration to fit the 7 A.M. Aug 22 position shown in Neumann et al. (1993). Because the 7 A.M. positions for the period Sept. 22-24 which are shown in the above publication were found to be supported by information in items 5), 8) and 9), such positions were kept unchanged. All positions above were used in the process of preparing the track for Storm 8, 1886 which is shown in Fig. 3.

Indications are that the storm was not strong in the vicinity of Hispaniola and Cuba: it is not mentioned by Sarasola (1928) and Martinez-Fortun (1942) who have published catalogs of Cuban cyclones. However, the hurricane status which Neumann et al. (1993) attribute to this storm was verified by the barometer reading of 29.15 inches (lowest pressure should have been lower than this value) reported as having been obtained at Brownsville at 11 P.M. Sept 22 (item 5) and by that, according to item 7), the wind reached 100 mph at that place.

Storm 9, 1886 (Sept. 22-30), H.

This is the same storm that Neumann et al. (1993) identify as Storm 8, 1886.

The following information was found in connection with this storm: 1) Bark "Mary". Sept. 22, at noon, lat. 24 40 N., long. 66 W., had a hard gale from E.S.E. veering to N.E., with terrific squalls of wind and rain and dangerous sea from E.S.E. to N.E.; Sept. 23, lat. 25 20 N., long. 66 20 W. (at noon); 2 A.M., hard gale, barometer falling, terrific squalls of wind and rain; 8 A.M., blowing a hurricane with very hard rain, very heavy cross sea, wind N.E., barometer falling to 29.25 inches; 1 P.M., barometer slightly higher, terrific hurricane with rain; 8 P.M., wind backing to N., heavy squalls, barometer 29.40 inches; midnight (Sept. 23-24), moderating, squally with rain; Sept. 26, lat. 25 17 N., long. 67 59 W. (at noon), had very heavy sea from N.E., N. and N.W.; midnight (Sept. 26-27), hard gale, barometer 29.60 inches, frightful sea; Sept. 27, lat. 25 17 N., long. 67 30 W. (at noon), had a hard gale with heavy rain and frightful sea, barometer 29.50 inches; vessel shipped sea fore and aft, tearing off all bulwarks; 6 A.M., barometer 29.45 inches, hard gale, clouds breaking, wind W. by N.; the appearance of the weather at this time was very peculiar, with a slaty gray. Noon (Sept. 28), barometer 29.60 inches, weather clearing to the S.W. (Monthly Weather Review, Sept. 1886). 2) Brigantine "Pearl". Sept. 24, lat. 25 40 N., long. 63 45 W., barometer falling, weather gloomy and threatening; noon position, Sept. 25, lat. 26 38 N., long. 64 11 W.; 4 P.M., heavy S.W. swell running through a S.S.E. swell; 6 P.M., violent squalls; at night, bluish lightning in the form of balls and big flashes, commencing in the S.W. and ending in the E.N.E.; 11 P.M., St Elmo's light at the yard-arms and royal trucks, with heavy rain, barometer falling all day; noon position, Sept. 26, lat. 26 38 N., long. 65 31 W., barometer 29.72 inches; day commenced with a N.E. wind of great violence and heavy rain, moderating at 6 P.M. to a severe gale; at 8 P.M., the sea began to run very high, breaking heavily; Sept. 27, severe gale throughout the day, wind hauling from E.N.E. to S. with heavy rain, compelled to use oil bags to save the vessel. Experienced heavy weather until Sept. 30, in lat. 32 N., long. 68

W. (Monthly Weather Review, Sept. 1886). Author's note: The barometer reading of 29.72 inches at noon Sept. 26 is obviously too high. 3) The dismasted brig "Elche", from Demerara, reported that on the morning of Sept. 25 at lat. 26 N., long. 66 W. ran into a hurricane which began from S.E. and veered to N.W. and then backed to S.E.. The storm continued for 72 hours and everything was washed from the decks by heavy seas (The New York Times, Oct. 17, 1886, p.14, col.1). 4) Bark "Reindeer" arrived from Antigua and reported having encountered a terrific gale on Sept. 30, in lat. 32 06 N., long. 68 40 W. (The New York Times, Oct. 11, 1886, p.8, col.1).

Based on the content of the above items, the author of this study felt that it was possible to prepare an entire track which was more accurate than the one on Neumann et al. (1993) as for Storm 8, 1886. Therefore, he estimated 7 A.M. positions as follows: Sept. 22, near 23.5 degrees N., 66.5 degrees W., based on item 1); Sept. 23, near 24.7 degrees N., 66.0 degrees W., also based on item 1); Sept. 24, near 25.3 degrees N., 65.5 degrees W, primarily on the basis of interpolation between positions on the previous and the next day; Sept. 25, near 25.7 degrees N, 65.0 degrees W., primarily based on item 2); Sept. 26, near 26.3 degrees N., 65.3 degrees W., based on item 2); Sept. 27, near 27.0 degrees N., 67.0 degrees W., based on items 1) and 2); Sept. 28, near 28.3 degrees N., 68.7 degrees W., primarily based on space-time continuity (along a smooth curve) to the Sept. 30 estimate; Sept. 29, near 30.0 degrees N., 69.3 degrees W., based on space-time continuity with the Sept. 30 estimate; Sept. 30, near 31.7 degrees N., 70.0 degrees W., based on information in items 2) and 4). The author's track for the storm is displayed in Fig. 3.

There are indications that this storm was incorporated into the circulation of a developing extratropical system off New England and Nova Scotia on Oct. 1. Barometer readings as low as 29.16 inches reported by the steamer "Adriatic" at 9:30 A.M. Oct. 1 in lat. 42 N., long. 63 15 W. and as low as 29.23 inches reported by the steamer "Etruria" at 1:40 P.M. Oct. 1 in lat. 42 50 N., long. 60 20 W. (Monthly Weather Review, Oct. 1886), were likely related to this merging storm.

The hurricane status given in Neumann et al. (1993) was confirmed by the barometer reading of 29.25 inches and the hurricane condition reported by the "Mary" at 8 A.M. Sept. 23 as well as by the "N.E. wind of great violence" reported by the "Pearl" on Sept. 26, while Storm 9, 1886 was at tropical latitudes.

Storm 10, 1886 (Oct. 8-13), H.

This is the same storm that Neumann et al. (1993) identify as Storm 9, 1886.

The following information was found about this storm: 1) The steamship "Professor Morse" encountered a hurricane on Oct. 8 in lat. 20 30 N., long. 85 20 W., during which oil bags were used on the weather side with good effect (Monthly Weather Review, Oct. 1886). 2) Havana, Oct. 7, 10 A.M. Since yesterday indications of the cyclonic movement have been observed at sea, but up to the present time it has shown itself of very small intensity; the

center of the storm is at the third quadrant, to S.S.W. (Monthly Weather Review, Oct. 1886). Author's note: This information as well as other information about the storm in Cuba was forwarded to the Signal Service by Rev. Benito Vines, S.J., director of the Belen College Observatory. 3) Havana, Oct. 8, noon. During last evening, the storm increased somewhat in intensity, and has, it appears, passed us by the W.S.W.; so it is at this time crossing the western extremity of the island (Monthly Weather Review, Oct. 1886). 4) Havana, Oct. 9, 10 A.M. During last evening and night the entire storm advanced slowly, passing by the west, which will prove, it seems, that the recurve entered the extreme west of the island, causing the vortex at this time (to be) at about 150 miles distance from here (Monthly Weather Review, Oct. 1886). 5) The barometer (at the Belen College Observatory, Havana) fell up to 4 A.M. Sunday (Oct. 10) at which hour it read 29.71 inches, corrected and reduced to sea level, with gusts of wind reaching at times 56 mph; dark sky, wind currently (10 A.M. Oct. 10) from S., oscillating slightly to S.S.W., diminishing little by little in intensity (Monthly Weather Review, Oct. 1886). 6) Vinales, Oct. 11, 1886. On Thursday Oct. 7, at 5 P.M. a breeze set in; later in the evening changed to S. and continued with heavy showers. At 9 P.M., the wind and rain grew heavier (Monthly Weather Review, Oct. 1886). Author's note: Vinales is a town located in the interior of Pinar del Rio province, to the N. of the city of Pinar del Rio. Unfortunately, no weather remarks from Oct. 8 on were given in this item. 7) Sabalo, Oct. 11, 1886. A cyclone with heavy wind and rain commenced during Oct. 7 and ended yesterday at daybreak. The winds commenced by the N. and ended by the W., the strongest being from the S. According to information received from Guane, great damage has occurred from the overflow of the Cuyaguanteje River (Monthly Weather Review, Oct. 1886). Author's note: Sabalo and Guane are towns located in the southwestern portion of Pinar del Rio province. 8) Oct. 8-9, 1886. A cyclone of good intensity, which formed near the southern part of Pinar del Rio province, caused considerable damage on the western end of Cuba, especially at Guane and Mantua. Torrential rains and gusty winds were felt at Pinar del Rio and, to a lesser extent, at Havana (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). Author's note: Mantua is a town near the northwestern coast of Pinar del Rio province. 9) New York, Oct. 9. A dispatch received from Cuba stated that a cyclone has passed over the western portion of the island (The Times, London, Oct. 11, 1886, p.6, col.3). 10) Report from the Signal Service observer at Key West, Fl. On Oct. 8 cyclonic conditions were observed; the weather was threatening and hazy with very brisk E. winds; barometer falling slowly; light sprinkling or misty rain. Oct. 9, rain in heavy squalls until 10:40 P.M., thunderstorm in the evening, moving from S.E. to N.W., wind E. with gale velocity at times in the evening, two gusts of 60 mph, barometer falling all day to 29.79 inches at 11 P.M., wind hauled slowly from E. to S.E. Oct. 10, gale continued, with wind hauling to S. and S.W. in heavy squalls; barometer 29.72 inches at 7 A.M.; between 1 and 2 P.M. wind hauled to S. and weather brightened; barometer remained stationary until 6 P.M., after which it rose and the weather

cleared (Monthly Weather Review, Oct. 1886). 11) Sandford, Fl. Heavy rains began falling at 12:15 P.M. Oct. 10 and continued until 3:15 P.M. Oct. 11. Total precipitation was 4.24 inches. The barometer fell slowly on Oct. 10 and rose on Oct. 11. Brisk E. winds prevailed on both days (Monthly Weather Review, Oct. 1886). 12) Steamship "Manhattan". Gale came on at 1 A.M. Oct. 9 from N.N.E. with very heavy squalls and slowly falling barometer. Wind backing very slowly to N. and continued to back around to S.W.; lowest barometer 29.26 inches in lat. 22 15 N., long. 87 18 W. at 4 P.M. On Oct. 10, at 11:20 A.M., kept course to the E.N.E., very heavy sea running from all points of the compass, with ugly, threatening-look weather, glass going up slowly all the time; arrived at Havana at 2 P.M. (Monthly Weather Review, 1886). 13) Steamship "Madrid". Oct. 10, 5 A.M., barometer 29.26 inches, wind E.S.E. force 10; 7 A.M., lat. 24 45 N., long. 84 22 W., barometer 29.08 inches, wind S.E. force 11; 9 A.M. to noon, wind in gusts blowing at times with hurricane force, swell from E.S.E. to S., waves 30 feet in height, air thick; noon, barometer 29.16 inches, wind S. force 12, wind began to moderate from S. shortly after midday (Monthly Weather Review, Oct. 1886). 14) Schr. "Aura B. Hutchison", from Chagres (Panama) to New York, encountered a terrific hurricane from E.N.E. to N. and W., 140 miles N. of Cape San Antonio on Oct. 10. The vessel was thrown on her beam ends and was under bare poles for 6 hours. On Oct. 14, 50 miles S. of Dry Tortugas picked up the captain and 4 sailors of the bark "Tres Auroras" (from Barcelona to Havana) which had sunk on Oct. 10 (The New York Times, Oct. 19, 1886, p.1, col.4). 15) Bark "Stormy Pettel", from St. Thomas for Mobile in 16 days, was in the hurricane of Oct. 8, 9 and 10 and ran before it under bare poles (The New York Times, Oct. 16, 1886, p.1, col.5). 16) The schooner "Joseph Farwell", from Laguna (Mexico) for New York, encountered a hurricane on Oct. 9 and 10, 80 miles N.W. of Dry Tortugas (The New York Times, Oct. 16, 1886, p.1, col.5). 17) Steamship "San Marcos". Oct. 9, 5:40 P.M., lat. 26 N., long. 86 30 W., barometer 29.90 inches and falling, wind N.E. by N. force 5, sky obscured and cloudy, heavy sea running from S.E. as well as from the quarter of the wind; ship sailed from above position 36 miles E. by S. and at 2 A.M. Oct. 10, barometer 29.60 inches, wind had increased and rain became constant; from thence the drift of the ship was about 3 mph S.W.; the barometer fell rapidly to 29.10 inches (?) at 10:40 A.M. and the wind had hauled to N. blowing with irresistible force for about 2 hours; at 12:30 P.M., barometer 29.15 inches, wind a heavy gale only blowing from N.W. for about 4 hours, then W.S.W. and S.W. for about 8 hours, or until 8:40 P.M., when clouds broken somewhat and wind went down to a gentle gale (Monthly Weather Review, Oct. 1886). Author's note: The barometer reading of 29.10 inches seems to be too low for 10:40 A.M. Oct. 11 because, according to wind observations, the ship seemed to have been closer to the storm center at 12:30 P.M. when a barometer reading of 29.15 inches was reported. In addition, winds from W.S.W. and S.W. should have lasted for 4 hours instead of for 8 hours in order for the stremer to have had diminishing winds and broken clouds at 8:40 P.M. as indicated. 18) Steamship "El Paso". Oct. 10, lat. 27 N., long. 87 40 W., had a gale from E.N.E., barometer 29.75 inches; Oct. 11,

lat. 27 N., long. 86 15 W., wind of hurricane force, backing slowly from E.N.E. to S.W (Monthly Weather Review, Oct. 1886). 19) Steamship "Colorado". Morning of Oct. 11, encountered a terrific hurricane from N.E. which continued to rage for 9 hours, when the wind changed to N.W. and continued in that direction for 10 hours; morning of Oct. 12, wind changed to E. and continued for 12 hours, when it came from an easterly point with a velocity of 90-100 mph, rising a terrific cross sea; barometer 29.05 inches at lat. 27 10 N., long. 89 W. (Monthly Weather Review, Oct. 1886). Author's note: No time was given for the barometer reading which probably represents the lowest pressure encountered by the "Colorado". 20) Mobile, Oct. 15, The bark "Scotia", from Ship Island to Mobile, went ashore at Horn Island (The New York Times, Oct. 16, 1886, p.1, col.5). 21) New Orleans, La. Oct. 11, a wind storm from the E. began at 8:15 P.M.; maximum velocity 38 mph from N.E. at 11:35 P.M.; the high wind continued until 4 P.M. Oct. 12. At the Mississippi quarantine station the storm was very severe, the wind blowing at 36 mph from N.E. In the parish of Plaquemines, the waters of the Gulf (of Mexico) were backed up over the rice fields for a distance of 35 miles inland. At Port Eads the wind blew hard on Oct. 10 and by the morning of Oct. 11 had increased in force, attaining at noon the velocity of a high gale. Port Eads and the surrounding country were completely submerged to a depth of two and a half feet (Monthly Weather Review, Oct. 1886). Author's note: The New York Times, Oct. 13, 1886, p.1, col.6, also published a note about the storm in the New Orleans area, adding that the water from Lake Pontchartrain covered many miles of the rear portion of the city. 22) Mobile, Oct. 12. The storm last night was heavy along the coast and vessels were detained from sailing (The New York Times, Oct. 13, 1886, p.1, col.6). 23) Galveston, Tx. The barometer fell slowly during Oct. 11 and morning of Oct. 12, accompanied by brisk N.E. winds. During the afternoon of Oct. 12, the wind backed from the N. to N.W. and increased in force, attaining at 10:45 P.M. a velocity of 55 mph; at that time the tide was very high and the lower part of the city overflowed although the usual effect of a N.W. wind is to lower the water on the bay. After 11 P.M. Oct. 12, the wind decreased in force and at 7 A.M. Oct. 13 was blowing from S.W. at a rate of 16 mph (Monthly Weather Review, Oct. 1886). Author's note: The New York Times, Oct. 13, p.1, col.6, also published a note about the storm in Galveston, adding that at 6 P.M. Oct. 12 the wind was blowing from N.W. at 45 mph and that the barometer had fallen 60 points since 7 A.M., indicating that the storm was near the city. 24) Storm of Oct. 8-13, 1886. Western Cuba and extreme East Texas. Center passed near Sabine Pass. Johnson's Bayou and Sabine Pass inundated. Overflow extending 20 miles inland. 150 lives lost. Nearly every house moved from its foundation (Tannehill, 1938). 25) Cyclone of Oct. 12, 1886. Texas Upper coast. Minimal. Tidal wave drowned 100 at Sabine (Dunn and Miller, 1960). 26) New York, Oct. 15, evening. According to the latest intelligence from Sabine Pass, the missing person number is 101, of which 90 are known to have drowned. The Gulf (of Mexico) seems to have moved over land in one high unbroken wall of water. The water dashed against the lighthouse in the bay in solid walls 50 feet high. Almost the entire coast of Cameron Parish, La. was

inundated by the Gulf waters (The Times, London, Oct. 16, 1886, p.6, col.2). 27) New Orleans, Oct. 13. The town of Sabine Pass was totally destroyed by the overflowing of the Sabine River. It is known that 65 lives were lost. Last night a hotel containing 15 or 20 persons was swept out into the bay and all the occupants were drowned (The New York Times, Oct. 14, 1886, p.1, col.6).

Information in the above items was found to support, in general, the storm track which is displayed in Neumann et. al. (1993) as for Storm 9, 1886. Therefore, no modifications were introduced along that track, which is presented as for Storm 10, 1886 in Fig. 3.

The hurricane status that Neumann et al. (1993) gave to this storm was fully verified by the information contained in many of the above items.

Storm 11, 1886 (Oct. 10-15), T.S.

This is a new storm case in the sense that it is not included in Neumann et al. (1993). However, without assigning a tropical origin to it, the Monthly Weather Review, Oct. 1886 took note of this system and, independently, Vines (1895) referred to it as a cyclone.

Documentation of this storm was based on the following information: 1) Citing Summary and Review of International Observations for the Month of October 1886 (published by the U.S. Signal Service in Dec. 1887) as the source, Father Vines of Havana stated that there was a cyclone near 30 degrees N., 60 degrees W. on Oct. 10 and indicated that, in his opinion, the presence of such a cyclone was responsible for the westward deviation which was observed along the track of a hurricane that was recurving in the eastern Gulf of Mexico on the same day (Vines, 1895). Author's note: It is obvious that Vines was referring to Storm 10, 1886. 2) The storm was first charted in lat. 35 degrees N., long. 53 W. on Oct. 14, from which position it passed eastward to lat. 35 N., long. 47 W. by Oct. 15. It was accompanied by strong gales and exhibited a central pressure about 29.50 inches (Monthly Weather Review, Oct. 1886). Author's note: The fact that the Monthly Weather Review stated that the storm was first chartered on Oct. 14 is not in contradiction with the existence of the storm on Oct. 10, 1886 as indicated about one year later in the U.S. Signal Service publication cited by Vines (item 1).

Based on the information given in item 1), the author of this study used 30.0 degrees N., 60 degrees W. for his 7 A.M. Oct. 10 estimated position. 7 A.M. positions for the period Oct. 11-13 were essentially determined by interpolation to the author's estimated position for Oct. 14, after allowing for a slight acceleration towards the end of the period; these positions were as follows: Oct. 11, 31.3 degrees N., 59.3 degrees W.; Oct. 12, 32.5 degrees N., 58.0 degrees W.; Oct. 13, 33.7 degrees N., 56.0 degrees W. The author's 7 A.M. Oct. 14 position was 34.7 degrees N., 53.0 degrees W., which is slightly different from the position mentioned in item 2) for that day. Finally, the author used 35.0 degrees N., 47.0 degrees W. (item 2) for his 7 A.M. Oct. 15 position. The author's track for Storm 11, 1886 is shown in Fig. 3.

No evidence of hurricane status was found and, therefore, the author decided to classify this system as a tropical storm. It can not be ruled out, however, that the storm might have shown some subtropical characteristics.

Storm 12, 1886 (Oct. 22-26), T.S.

This is the same storm that Neumann et al. (1993) identify as Storm 10, 1886.

The following information was found in connection with this storm: 1) Scattering vessel reports indicated the presence of a cyclonic disturbance in the vicinity of Haiti on Oct. 22 (Monthly Weather Review, Oct. 1886). 2) Storm of Oct. 22-23, 1886. Santo Domingo (Tannehill, 1938). 3) Oct. 22-23, 1886. Perturbation of great area but slight energy crossed S. of Santiago de Cuba and reached a position to the S. of Camaguey, then recurving to the N.E. There was no important damage. Showers and gusty winds from N. were felt from Havana eastward (Sarasola, 1928) Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). Although the vast disturbance is said to have crossed over eastern Cuba, the storm itself could have developed farther east within the large envelope of the disturbance, which would be in accordance with information in items 1) and 2) and would also fit a better space-time continuity with information in the remaining items. 4) Steamship "L. & W. Armstrong". Oct. 22, lat. 21 11 N., long. 64 20 W. (at noon); at 22 hours, barometer falling slowly, heavy cloud bank lying from S.E. to S.S.W.; noon barometer 29.70 inches, wind S.S.E. force 6. Oct. 23, lat. 23 50 N., long. 64 54 W.; at 3 hours, barometer 29.60 inches, wind S.S.E. force 7, sea rising, rain squalls; 5 hours, heavy rain squalls with thunder and lightning, barometer falling slowly, wind force 7, sea high but regular; 10 hours, barometer 29.51 inches, wind S.S.E. force 7, heavy sea and squally; 12 hours, wind S.S.E. force 7 to 8, heavy rain keeping the sea down, barometer 29.50 inches; 15 hours, barometer 29.40 inches, wind S.S.E. force 8 to 9, high sea but regular; 15 hours and 20 minutes, after a heavy rain squall with thunder and lightning, the wind hauled to S.W. after a few moments lull. We had been steering N., hoping to clear the storm-track, now we had to steer N.E., finding the S.E. sea dangerous; at 16 hours and 30 minutes, hove to on starboard tack, barometer 29.30 inches; 18 hours, slight breaking away of clouds to the eastward, a heavy, dark bank of clouds in the westward extending from S. to W.N.W., clear overhead, wind hauled to S.S.W. and W., barometer rose slowly, sea going down and wind decreasing (Monthly Weather Review, Oct. 1886). Author's note: It is obvious that the hours mentioned were counted starting at noon each day. The vessel appears to have been very close to the center of the storm from 15 hours 20 minutes counted after midday Oct. 23 (3:30 A.M. Oct. 24) to the last observation taken at 18 hours after midday Oct. 23 (6 A.M. Oct. 24). The barometer readings reported by the "L. & W. Armstrong" appear to be a bit too low. 5) Bark "Essex" Oct. 23, in lat. 26 17 N., long. 64 58 W. (at noon), had a strong gale from E.S.E. with rain and squalls; wind backed to N.E. at 8 P.M. with heavy rain squalls and moderated at

midnight Oct. 23-24 (Monthly Weather Review, Oct. 1886). 6) Ship "Magellan". Oct. 24, lat. 27 49 N., long. 62 31 W., had a heavy gale from E. to N.E., barometer 29.45 to 29.80 inches; lightning all around the compass; gale lasted, with heavy rain and sea, 24 hours (Monthly Weather Review, Oct. 1886). 7) Bark "Lilian B. Jones". Oct. 25, in lat. 25 38 N., long. 58 07 W. (at noon); at 2 A.M., a brisk gale began from S.S.W., increased to a hard S.S.W gale with heavy sea; 5 P.M., a heavy squall struck the vessel and hove her on beam ends, hard gale continued, shifting to N. at 9 A.M. Oct. 26; noon Oct. 26, lat. 25 38 N., long. 58 33 W., brisk gale continued until midnight, then moderated; lowest barometer 29.78 inches at 4 P.M. Oct. 25 (Monthly Weather Review, Oct. 1886).

Major modifications along the track for this storm, which is shown in Neumann et al. (1993) as for Storm 10, 1886, were implemented by the author of this study. The modifications suggested by the content of the above items were of such an extent that the author decided to prepare an entirely new track. Therefore, the author estimated 7 A.M. positions as follows: Oct. 22, near 20.5 degrees N., 72.0 degrees W., based on information in items 1) and 2); Oct. 23, near 23.7 degrees N., 68.7 degrees W., primarily on the basis of information in items 4) and 5) and on space-time continuity; Oct. 24, near 25.7 degrees N., 64.5 degrees W., chiefly based on information in item 4) and, to a lesser extent, on information in items 5) and 6); Oct. 25, near 27.0 degrees N., 60.7 degrees W., based on information in items 6) and 7) and on space-time continuity; Oct. 26, near 27.7 degrees N., 57.0 degrees W., on the basis of item 7) and on space-time continuity. The author's track for Storm 12, 1886 is presented in Fig. 3.

There was no evidence that the storm had reached hurricane intensity in spite of the barometer reading of 29.30 inches reported by the "L. & W. Armstrong" (item 4), which is probably too low. Therefore, the classification as a tropical storm given in Neumann et al. (1993) was accepted.

Special statement.

The author of this study strongly believes that more than 12 storms did form in 1886. According to Vines (1895), that year offered an uninterrupted series of cyclones and cyclonic perturbations which extended from May to late October. And Father Vines added: "only the ones which I observed were about 20, out of which 14 or 15 were true cyclones" (Vines, 1895).

The author of this study took note of three possible cyclones in addition to the twelve which were previously discussed. However, the information which was available to him about these systems was insufficient to fully verify their existence and/or to determine a reliable evolution for them. Consequently, these possible cases were not included in the present study.

The cases were as follows:

A) Case of Jul. 6-7, 1886. Information about this system near western Cuba was found in the Monthly Weather Review, Jul. 1886 and also in The New York Times, Jul. 15, 1886, p.8, col. 2. It was obvious that Father Vines, of Havana, was the source of the

information contained in both publications. It was stated that the alleged storm apparently approached Cuba in the evening of Jul. 6, 1886 but then moved over Yucatan.

B) Case of Sept. 7, 1886. Tannehill (1938) mentioned this storm as having occurred at Pinar del Rio (western Cuba). On the other hand, the catalog of Cuban cyclones by M. Gutierrez Lanza, which is included in Sarasola (1928), stated that it was a weak cyclone which passed S. of Pinar del Rio, causing only showers.

C) Case of Oct. 1-14, 1886. Vessel reports indicated the presence of a cyclonic area over the western Caribbean on Oct. 1-2, but were not sufficiently numerous to accurately locate a center. By the morning of Oct. 3, the depression had passed N. of the West Indies and was central near lat. 29 N., long. 76 W. (at a good distance to the east of northern Florida). From this position, it moved northeastward to lat. 37 degrees N., long. 65 degrees W. on Oct. 7 and then continued to the vicinity of the British Is. on Oct. 14 (Monthly Weather Review, Oct. 1886). The author of this study is skeptical about the linkage between the disturbance in the western Caribbean and the one to the east of N. Florida and, according to his own analysis, he believes that the latter disturbance formed along a cold front. According to him, such a front extended to the S.W. from a low pressure area of 29.40 inches located near Boston early on Oct. 1 (Monthly Weather Review, Oct. 1886), was apparently met by the "City of Washington" off the coast of Delaware about 6:30 A.M. Oct. 1 and produced a N. veering to N.E. gale on board the "River Ettrick" on the same day (Monthly Weather Review, Oct. 1886). Based on the author's interpretation of the observations taken by the bark "Mary" (Monthly Weather Review, Oct. 1886), the cold front seemed to have reached the vicinity of lat. 32 N., long. 72 W. by the evening of Oct. 2. In the author's opinion, it would not be easy to determine if the low pressure area which apparently formed along the front ever acquired tropical characteristics.